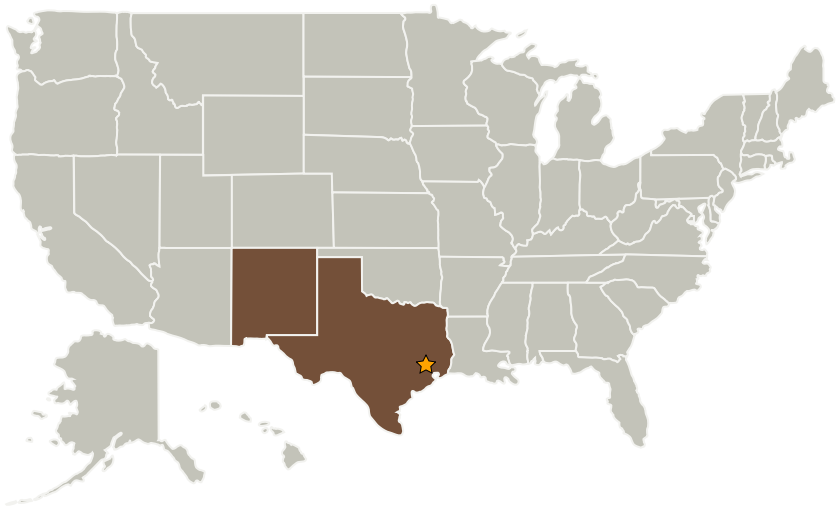
High Recovery, Low Fouling Reverse Osmosis Membrane Elements for Space Wastewater Reclamation, Phase I

Completed Technology Project (2007 - 2007)

Project Introduction

With the expected extension of duration of the space missions outlined in NASA's Vision of Space Exploration, such as a manned mission to Mars or the establishment of a lunar base, the need to produce potable water from onboard wastewater streams in a closed-loop system becomes critical for life support and health of crew members. Reverse osmosis (RO) is a compact process that has proven its ability to remove inorganic and organic contaminants from space mission wastewater. The objective of this Phase I study is to ascertain whether composite hollow fiber membrane elements are a more efficient alternative to the current generation of spiral wound membrane elements for the reclamation of space mission wastewater. In particular, the use of low-energy composite hollow fiber membrane elements being developed at SFST for treating multi-component (both inorganic and organic contaminants) wastewater streams found aboard spacecraft will be investigated. The higher membrane surface area of these composite hollow fiber membrane elements enables the RO membrane element to have 30% higher water productivity at substantially higher single-pass recoveries (60-75% vs 10-20% for spiral wound elements). Furthermore, we will also investigate possible solutions to minimize fouling of these hollow fiber membranes by increasing the hydrophilicity of the membrane surface using a variety of surface modification techniques. Such hollow fiber membranes are expected to show better resistance to fouling by hydrophobic compounds, and thus these membranes will be less likely to be clogged by potential foulants. These improvements to the RO membrane element have the potential to decrease the mass, size and power requirements of the RO subsystem, and also decrease the size of the pre-treatment unit.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Santa Fe Science and Technology, Inc.	Supporting Organization	Industry	Santa Fe, New Mexico

Primary U.S. Work Locations	
New Mexico	Texas

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.1 Environmental Control & Life Support Systems (ECLSS) and Habitation Systems
    - TX06.1.2 Water Recovery and Management